NOTES

Septic Arthritis Involving Capnocytophaga ochracea

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Septic arthritis of the knee developed in a 21-month-old child. The causative organism, isolated from two separate arthrocenteses, was identified as Capnocytophaga ochracea morphologically and by biochemical reactions. Previous human infections (bacteremias) have occurred in granulocytopenic hosts with concomitant oral pathology including periodontitis and gingivitis. No abnormalities of oral hygiene were present in this patient, and granulocyte numbers were normal or elevated. Eradication of the infection was accomplished with 8 weeks of antibiotic therapy combined with surgical drainage. Septic arthritis expands the spectrum of infections reported to be caused by Capnocytophaga spp.

Bacterial arthritis in children is most often caused by Hemophilus influenzae or Staphylococcus aureus, although other organisms have been causative. The diagnosis may occasionally be inferred from positive blood culture isolates; however, direct aspiration of affected joints is more specific. Antimicrobial therapy is optimally determined from susceptibility tests performed on the isolated organism.

An infant female presented with an acute monoarticular arthritis of the knee. Separately performed arthrocenteses yielded an unusual gram-negative pleomorphic bacillus identified as Capnocytophaga ochracea. Previous literature reports did not demonstrate septic arthritis as being caused by this organism.

This report details the management course of septic arthritis due to C. ochracea.

Case report. A 21-month-old female developed an acute monoarticular arthritis of the left knee. Approximately 6 weeks before presentation she experienced the onset of an asymptomatic swelling of the left calf and popliteal fossa. Roentgenograms of the knee revealed soft tissue swelling without evidence of bony involvement. The clinical impression was that of a hematoma secondary to trauma. Over the following few weeks the calf edema subsided, but a boggy swelling of the knee (felt to be synovitis) was noted. Throughout this period there was no pain or limitation of motion or weight bearing of the leg, and the child was free of fever. On the day of admission to Wilford Hall Medical Center she awakened from sleep with a complaint of pain in the left knee and would not bear weight on the leg. An oral temperature of 103°F (39.4°C) was documented by the parents. The left knee was larger than previously noted, with local warmth. At no time before admission were antibiotics administered.

Historically, the child’s mother had an autoimmune inflammatory arthritis syndrome. At this time she was in remission and on no medications.

There was no previous significant medical history for the child, and she was breast feeding.

Physical examination disclosed a well-nourished female with a temperature of 101.4°F (38.5°C), a pulse of 188, and blood pressure of 85/40. The left knee circumference was 23.5 cm; the right knee was 21.5 cm. The knee was edematous without erythema and with decreased extensor motion. The remainder of the exam was noncontributory.

A complete blood count showed a leukocyte count of 19,500/mm³ with 53% polymorphonuclear leukocytes, 2% bands, 32% lymphocytes, and 13% monocytes. The platelet count was 521,000. An erythrocyte sedimentation rate (Westergen) was 25. Roentgenograms of the knee again showed soft tissue swelling without bony abnormalities. A technetium-99 radionuclide scan revealed hyperemia of the knee without evidence of osteomyelitis. An arthrocentesis yielded purulent fluid. The cell count was 25,000/mm³ with 95% polymorphonuclear leukocytes. The synovial fluid glucose was 37 mg% with a protein of 2.5 g%. A Gram stain was negative for organisms. A Bactogen (Wampole Laboratories, Div. Carter-Wallace, Inc., Cranberry, N.J.) test was negative on knee fluid.

Treatment of the child was begun presumptively with parenteral cefamandole and penicillin due to the possibility of H. influenzae arthritis. She became afebrile within 24 h. Clinical improvement was noted as well, but the knee edema persisted at the prehospitalization size. An arthrotomy was performed on day 4 due to persistent effusion. About 8 ml of purulent fluid was obtained; the cartilage did not exhibit any destructive changes. Tissue specimens for histopathological analysis were lost.

The initial arthrocentesis fluid was received in the laboratory in aerobic and anaerobic Bactec bottles. A second arthrocentesis fluid taken on the same day was received in the laboratory and was inoculated aerobically to Trypticase soy agar (BBL Microbiology Systems, Cockeysville, Md.) with 5% sheep blood, enriched chocolate agar, MacConkey agar, and cooked meat broth. The specimen was also inoculated to Centers for Disease Control (CDC) anaerobic blood agar, anaerobic phenytoin alcohol agar, kanamycin-vancocin blood agar, bacteroides bile esculin agar, and cooked meat broth with thioglycolate and incubated anaerobically. An organism was initially isolated in the anaerobic Bactec bottle containing material from the first arthrocentesis. Subsequently, the same organism was isolated from the anaerobic culture of material from the second arthrocentesis. A Gram stain of anaerobic broth on day 4 revealed a gram-negative, pleomorphic, fusiform bacillus. An anaerobic subculture on day 10 grew a pure culture of an organism with identical staining characteristics.

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No growth occurred in the aerobic Bactec bottle or on
MacConkey agar. The anaerobic Bactec bottle was subcultured
to CDC anaerobic blood agar, anaerobic phenylethyl
alcohol agar, kanamycin-vancymycin blood agar, and bac-
teroides bilesesculin agar and aerobically to Trypticase soy
agar with 5% sheep blood, enriched chocolate agar, and
MacConkey agar. After 96 h, pinpoint-sized colonies were
observed growing anaerobically on CDC blood agar and
phenylethyl alcohol agar. A slight, golden, partial hemolysis
occurred on CDC anaerobic blood and phenylethyl alcohol
agar. (After several subcultures, alpha-hemolysis was pro-
duced on an enriched chocolate formulation prepared in-
house.) With continued incubation two different colony
types were apparent. These were identified separately and
yielded identical reactions. One colony type was circular,
smooth, and slightly convex. The second colony type was
flat with an irregularly spreading edge and appeared to pit
the agar. Some adherence of the colonies was noted and light
yellow pigmentation was observed.

As originally isolated, this organism was strictly anaero-
bic, but after subculture could be grown in a CO2-enriched
atmosphere. The second arthrocentesis and all anaerobic
subcultures were incubated at 35°C in a Forma Scientific
glove box under 5% H2-10% CO2-85% N2 for periods
ranging from 2 to 10 days. Later subcultures were incubated
from 48 to 72 h under increased CO2.

The initial isolate was inoculated anaerobically to API A
(Analytab Products, Plainview, N.Y.) and to Minitek sys-
tems. Characteristics are shown in Table 1. Later subcul-
tures from isolates grown in a CO2-enriched environment
were inoculated to Corning Uni-N/F-Tek (Flow Labora-
tories, McLean, Va.) and to API E systems incubated
anaerobically. No biochemical changes had occurred after 72 h
of incubation at 35°C.

The isolate from the second arthrocentesis was identified
with API A and Minitek systems incubated anaerobically. In
addition, it was inoculated to standard tubed media with
infusion sugars according to the Elizabeth O. King protocol
(18). Calf serum was added to the inoculum to enhance
growth. Biochemical reactions are shown in Table 1.

With the (anaerobic) API A system supplemented with
calf serum, the organism had positive reactions to glucose,
lactose, saccharose, maltose, trehalose, and o-nitrophenyl-
β-D-galactopyranoside. Negative reactions were noted to
oxidase, catalase, indole, gelatin, and carboxylase. Nitrate
was also negative. Esculin hydrolysis was positive.

On oxidation-fermentation glucose (open and closed),
the organism was fermentative by both the Corning (Flow
Laboratories) Uni-N/F-Tek and API methods. (Motility was
delayed and slow to be observed and was similarly observed
on motility medium.)

This bacterium was identified as C. ochracea.

One colony of S. aureus was recovered from a single plate
(Trypticase soy agar with 5% sheep blood) after several
subcultures. The S. aureus colony was not located on the
streaked area of the plate and was not recovered from
cooked meat broth or from either Bactec bottle; therefore,
it was considered to be a plate contaminant and not significant
to the child's illness. Although its significance was doubted,
the antibiotic regimen chosen covered both organisms.

Antimicrobial susceptibility tests were performed by an
anaerobic broth disk elution susceptibility test (method of
Wilkins and Thiel [19]). The organism was sensitive to
cefamandole, cephalothin, cefotixin, and metronidazole but
was resistant to penicillin.

After 8 days of parenteral cefamandole the child was
switched to oral cefaclor. A peak serum minimal inhibitory
dilution and minimal bactericidal dilution was 1:16. Penicillin
had been discontinued after 3 days of therapy. Cefaclor was
continued for a total of 6 weeks. After discussion with S.
Finegold (the organism was thought to be a Fusobacterium
species), metronidazole was given for an additional 2 weeks
(total therapy, 8 weeks).

Repeated roentgenograms were negative for osteomyelitis.

Boggy synovitis persisted for 6 months before resolution.
An intensive range-of-motion exercise program resulted in
total return of function of the knee. At last examination, 12
months after discharge, the sole residual was a slightly
longer leg on the left (2 cm), probably due to reactive bony
growth of the epiphysis on the left.

Capnocytophaga is a recently defined genus of bacterial
organisms capable of unique gliding motility (14). As the
genus name implies, the organisms are capnophilic and will
grow favorably in a CO2 or anaerobic environment. When
initially isolated, however, they may exhibit anaerobic
growth characteristics only.

The ecological niche of this group of organisms appears to
be the gingival crevice and oral cavity (10, 11). Capno-
cytophaga spp. have been implicated in gingivitis and juvenile
periodontosis (10, 13). Investigations of juvenile periodonto-
sis have demonstrated that these organisms elaborate potent

<table>
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<th>TABLE 1. Biochemical reactions of C. ochracea recovered from two isolates from synovial fluid</th>
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<td>Substrate</td>
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<td>Ornithine decarboxylase</td>
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<td>Motility agar</td>
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toxins, one of which inhibits chemotaxis of granulocytes (2, 13). Other elaborated products have been identified, but their significance remains undetermined (5, 6, 15, 16).

Identification of the organisms depends on microscopic morphology and biochemical reactions. The organism is a pleomorphic, fusiform, gram-negative bacillus. As stated above, it grows anaerobically or in a CO2 environment. Biochemical reactions differ among the three species (14, 20). Interspecies variations may also be seen.

Cultural isolates have been obtained from the throat, blood, finger, vagina, submaxillary gland, gingiva in periodontitis, spinal fluid, and from a neck infection (11). Clinically encountered systemic infections have been infrequently reported. Thirteen patients (seven adults and six children, [<16 years old]) with bacteremia, one with concomitant pneumonia, have been reported (1, 4, 7–9, 12, 13). Four had acute myelogenous leukemia, three had acute lymphocytic leukemia, two had multiple myeloma, and one each had Hodgkin’s disease, poorly differentiated lymphocytic lymphoma, myeloid metaplasia, and metastatic adenocarcinoma of the colon. Of note was that almost all patients were granulocytopenic or were being treated with chemotherapy at the time of infection. In addition, only one patient did not have oral pathology defined as gingivitis, oral ulcerations, or periodontitis.

Blood cultures exhibited delayed growth macroscopically. Several isolates became positive at 5 to 7 days, usually in the anaerobic bottle. Macroscopic growth did not occur in one case, and the organism was recovered from a blind subculture on day 7. The synovial fluid culture (anaerobic Bactec bottle) in the present case became positive on day 4, but the interpretation of true macroscopic growth was questioned.

Most of these patients survived their sepsis due to Capnocytophaga sp. Only one death could be directly attributed to the infection. That patient had not been treated with any antibiotic regimen.

Numerous empiric antibiotic have been used in the therapy of the febrile patient with neutropenia and sepsis due to Capnocytophaga sp. Two recently completed studies have shown susceptibility of most strains to penicillin, ampicillin, carbenicillin, clindamycin, erythromycin, tetracycline, chloramphenicol, and metronidazole (3, 17). Cefoxitin was the best cephalosporin tested, with variable results obtained with other cephalosporin antibiotics.

In contrast to all previously described patients, this child was not granulocytopenic, nor were oral ulcerations or oral pathology noted. Presumably a transient bacteremia had occurred, possibly related to brushing of the teeth with secondary infection of the knee joint. Chronicity of the synovitis-arthritis may have been partially related to the relative avirulence of the organism and possibly local dysfunction of neutrophils.

Treatment with cefamandole and cefaclor for 6 weeks and metronidazole for 2 weeks eradicated the infection. Adequate serum killing power was documented while the patient was being treated with the oral cephalosporin antibiotic.

This report documents the occurrence of septic arthritis involving Capnocytophaga sp. in a non-granulocytopenic patient with normal oral hygiene and extends the recognized pathogenic spectrum of infection by these organisms.

LITERATURE CITED